

## MAMMOMAT 1000/3000 Nova

**SP**

### Maintenance Instructions

System

MAMMOMAT 1000/3000 Nova

The protocol SPB7-230.105.02.05.02 is required for these instructions

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## 1 General information

### 1.1 Training

- Self-instruction packet **or** training workshop **and** at least 1 installation

## 1.2 Required documents

• Planning Guide	SPB7-230.021...
• MAMMOMAT 1000/3000 Nova Wiring Diagrams	SPB7-230.051...
• Installation and Start-Up Instructions	SPB7-230.033...
• Service Program	SPB7-230.114...
• Maintenance Protocol	SPB7-230.105...
• Instructions for Use	SPB7-230.201...
• Supplement to the Instructions for Use (Stereo)	SPB7-230.203...

## 1.3 Required tools, measurement and auxiliary devices

**NOTE**

All tools, measurement and auxiliary devices, with the exception of those marked with "\*", are listed in the STC (Service Tools Catalog) along with their specifications.

- Oscilloscope
- Digital multimeter
- mAs meter
- Service PC with connection cable
- SIB phantom **or** Normi 7 **or** 4-cm Plexi **or** customer phantom\*
- Sensitometer/densitometer
- Film pack 24 x 30 or larger
- Cleaning agents\* specified in the operating instructions
- Protective conductor meter
- Spring scale 0-20 kp (1 kp increments) with cord\*
- Water level
- Spray enamel\* according to the PG (to touch up chipped paint)
- Standard installation tools\*
- Electric screwdriver\* with sockets (recommended)

## 1.4 Required lubricants

- All purpose grease PD2
- Viscogen oil



## 1.5 Text emphasis



**DANGER** indicates that there is an immediate danger of death or serious physical injury.

⇒ n.a.



**WARNING** indicates that there is a risk of possible death or serious physical injury.

⇒ n.a.



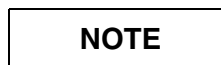
**CAUTION** used with the safety alert symbol indicates that there is a risk of slight or moderate physical injury and/or damage to property.

⇒ n.a.



**NOTICE** used without the safety alert symbol indicates that non-compliance may cause a situation leading to an undesirable result or state other than death, physical injury or damage to property.

⇒ n.a.



**NOTE** contains information provided with special emphasis to facilitate proper use of the equipment or proper execution of a procedure, i.e. hints, tips.

## 1.6 Safety information and preventive measures

**NOTE**

- When completing repair work and tests, please note:
  - the product-specific safety information in the document,
  - the safety information in TD00-000.860.01... ,
- When the system is switched off via the operating panel or S2/D711, line voltage is still present at the line voltage connection for the generator, at line voltage filter Z1, at transformer T1, at transformer T10, and on board D711 (refer to circuit diagram).
- After switching off the system, approximately 380 V DC may be present in the intermediate circuit as indicated by the V24 LED on board D710. Within 3 minutes, the voltage will drop to less than 30 V, and the LED will go out.
- Tests or adjustments that must be made with the radiation switched on are identified by the radiation warning symbol.  
During these types of adjustments, radiation protective clothing must be worn.

## 1.7 Explanation of abbreviations

Abbrev.	Explanation
SI	Safety Inspection
SIE	Safety Inspection, Electrical
SIM	Safety Inspection, Mechanical
PM	Preventive Maintenance
PMP	Preventive Maintenance, Periodic
PMA	Preventive Maintenance, Adjustments
PMF	Preventive Maintenance, Function Check, Operating Value Check
Q	System Quality, Image Quality
QIQ	Image Quality
QSQ	System Quality Check
SW	Software Maintenance
CSE	Customer Support Engineer
CS No.:	Customer-specific number
IVK	Installed Volume Component
WE	Maintenance Unit

## 1.8 Symbols

Checks and adjustments that must be performed with the radiation ON are identified by the



radiation warning symbol.

## 2 System

### 2.1 Checks

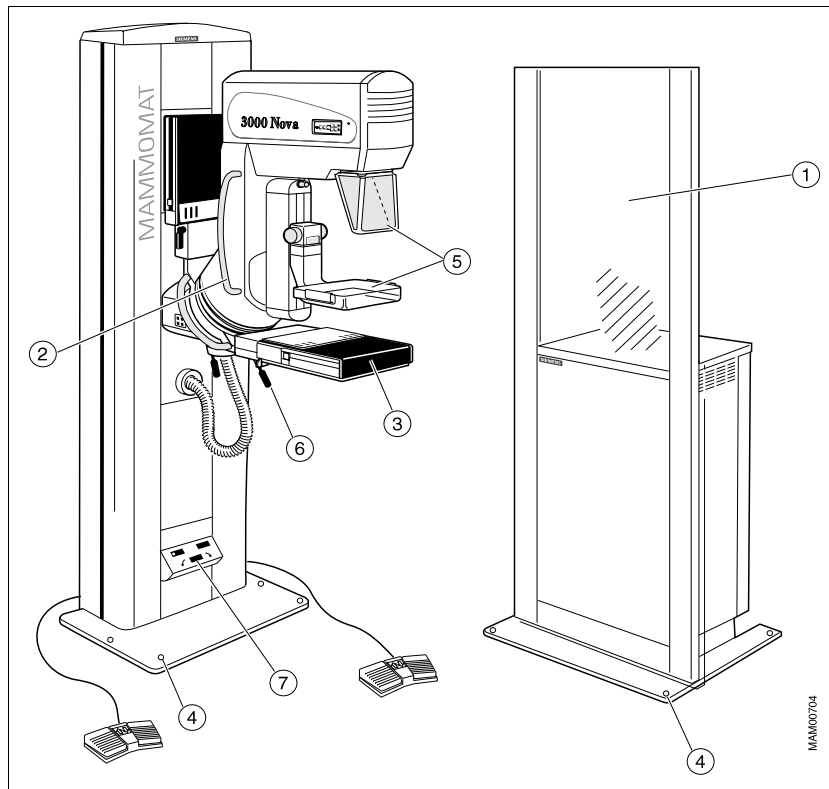


Fig. 1: MAMMOMAT checks

#### PMP Radiation protection

- Check the radiation protection shield for possible damage (1/Fig. 1 / p. 13).
- Information regarding the lead equivalent value must be legible.

#### SIM Swivel arm/PPS tube attachment

- Check the swivel arm/PPS tube attachment by pulling on both support rails (a minimum play of approximately  $\pm 2^\circ$  is correct). (2/Fig. 1 / p. 13).

#### SIM Basic table

- Check the mounting of the basic table as well as the locking mechanism for the exposure system (3/Fig. 1 / p. 13).

#### SIM Flying wing (MAMMOMAT 3000 Nova only)

- Check the "Flying Wing" locking mechanism (wing  $\triangle$  basic table). Swivel "wing 1" ("wing 1" is the table with the stereo connector) toward "wing 2" and back (6/Fig. 1 / p. 13).

#### SIM Level

- Verify that the system is level with respect to the floor. Check the level screws (4/Fig. 1 / p. 13) with a water level and, if available, the floor mounting (optional).

**PMP    Face shield and compression plate**

- Check the face shield and compression plate for correct seating and for damage ([5/Fig. 1 / p. 13](#)).

## 2.2 Preparations

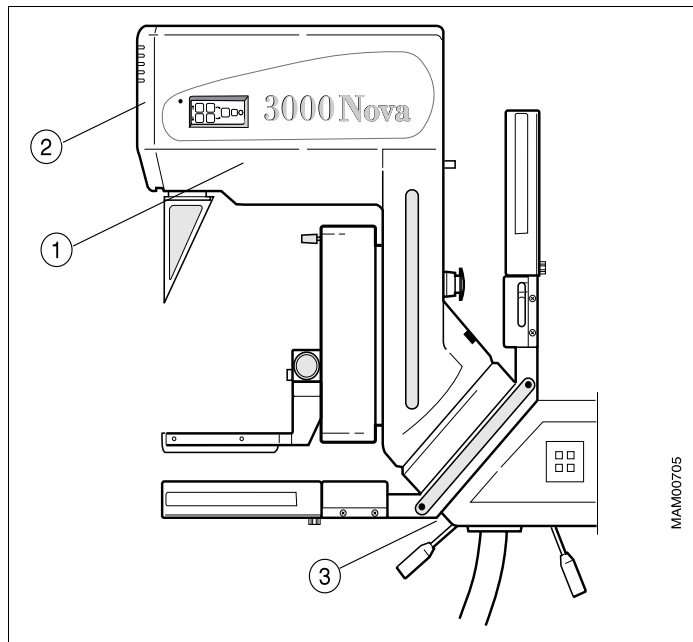


Fig. 2: X-ray tube covers

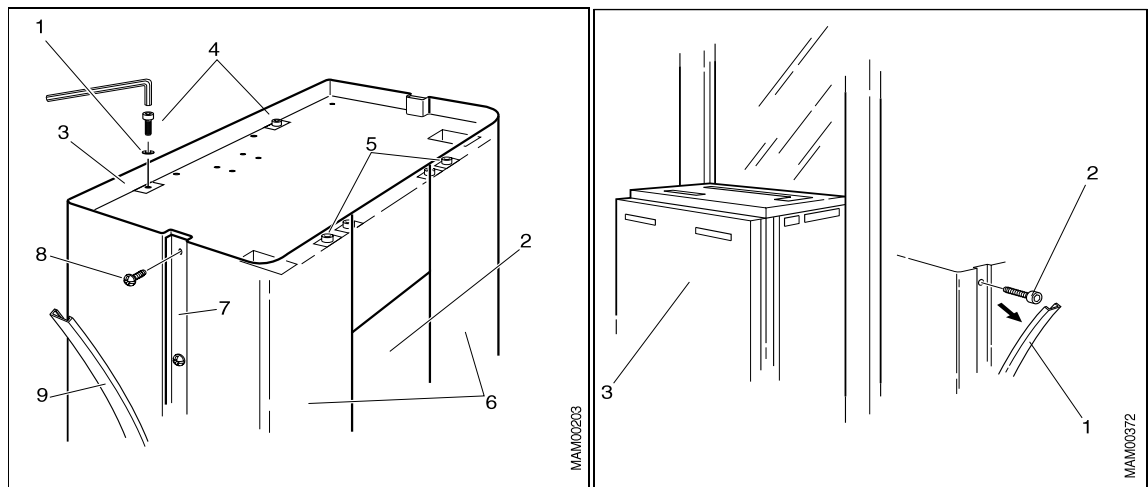


Fig. 3: Covers

Fig. 4: Generator front covers

### SIE Cables

- System OFF
- Check the condition of the cables and the corrugated tubing (3/Fig. 2 / p. 15) while removing the following covers:
  - X-ray tube covers (left, right, and front) (1, 2/Fig. 2 / p. 15)
  - All covers of the stand (3, 6/Fig. 3 / p. 15)

**NOTE**

The edges of the metal curtain are very sharp and can cause severe injury. Attach the protective strips.

- Generator front cover ([3/Fig. 4 / p. 15](#)).



### 3 Column stand

#### 3.1 Checks

**SIM Steel ropes**

- Do the steel ropes (balancing and flap), the drive belt, the suspension, or the pulleys have any damage (e.g. fraying or splitting) or show signs of wear?

**PMA Oil and grease**

- If they are OK, lightly oil the wire cable, grease the rails, and then remove the protective strips.

**SIE Limit switches**

- System ON. Move the lifting carriage up and down several times, the lifting carriage should be in an upright (0°) position.

**NOTE**

It is normal to hear some noise from the rotation of the radiation filter in the collimator when switching the system ON.

- Do the limit switches stop carriage travel at the top and at the bottom?
- Activate safety switch S882. System movements must be blocked.

**PMF Vertical travel**

- Is the vertical travel smooth and noiseless?
- Switch OFF the system and attach the protective strips once again.

**SIM Safety catch and rotation safety catch**

- Do the safety catch (1/Fig. 1 / p. 17) and rotation safety catch (2/Fig. 1 / p. 17) have any visible damage? Are the springs in good condition?

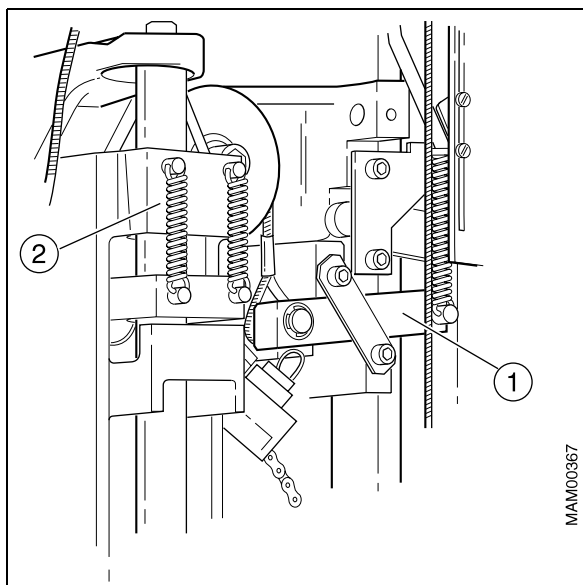
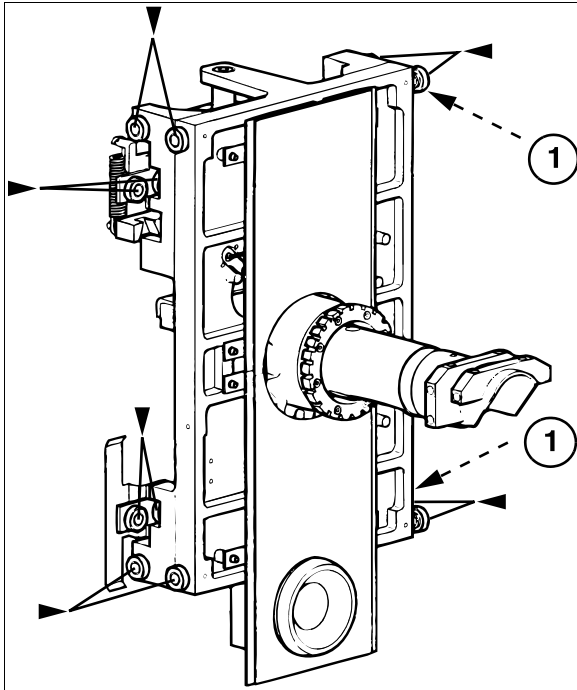


Fig. 1: Safety catch

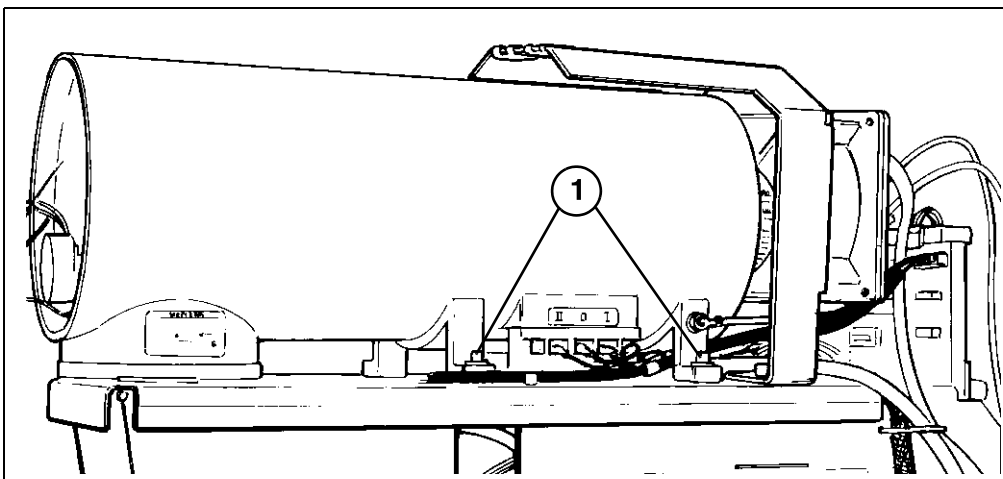
**SIM Ball bearings**

- Depending on the serial no. of the MAMMOMAT, the lifting carriage is equipped with either ten or twelve ball bearings (refer to [\(Fig. 2 / p. 18\)](#)). The two ball bearings that are missing in MAMMOMATs with ten bearings are only indicated in the figure. Check that all ball bearings are in place and that they show no sign of damage.



*Fig. 2: Lifting carriage*

Pos. 1 Not on all MAMMOMATs

**SIM Mounting for the X-ray tube**

*Fig. 3: X-ray tube*

- Check the mounting for the X-ray tube unit (1/Fig. 3 / p. 18).

## PMA Grease the grid spindle

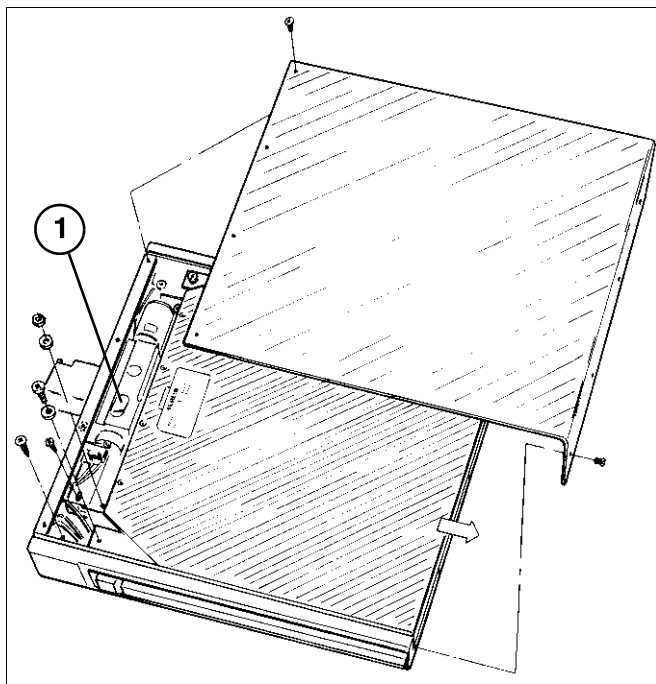


Fig. 4: Grid spindle

- Remove the cover plate from the object table and lightly grease the grid spindle (1/Fig. 4 / p. 19). Reattach the cover plate.

## 4 Compression and system movements

### 4.1 Testing the "Compression" function

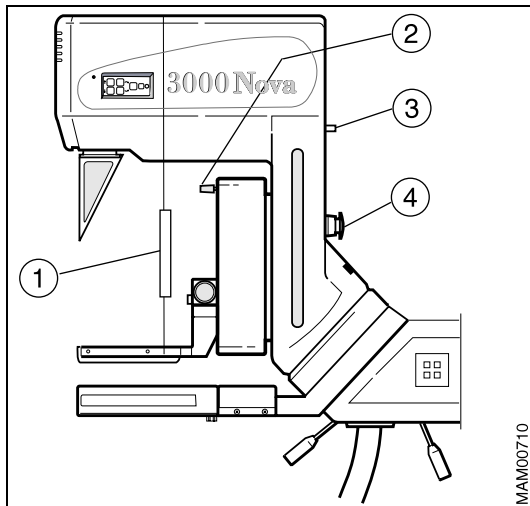


Fig. 1: Compression

- Attach the spring scale as shown in (1/Fig. 1 / p. 20) and be careful not to damage the compression plate during the following tests: Tolerance:  $\pm 1$  kp.

#### 4.1.1 Switching off

- System ON

##### PMF Presetting

- Select any value (e.g. 6 kp) on the potentiometer (2/Fig. 1 / p. 20) and compress. Does the compression unit switch off at this setting?

##### SIE Max. value switch off

- Select the maximum value (20 kp) with the potentiometer (2/Fig. 1 / p. 20). (20 kp). Does the unit switch off when it reaches the maximum value?
- Correct display (7/Fig. 1 / p. 13).

##### PMF OPCOMP

- Position your forearm between the object table and the compression plate and check the OPCOMP function.
  - ⇒ Typically, the cutoff value is between 6 and 10 kp at the factory setting.

## 4.2 Testing the "Decompression" function

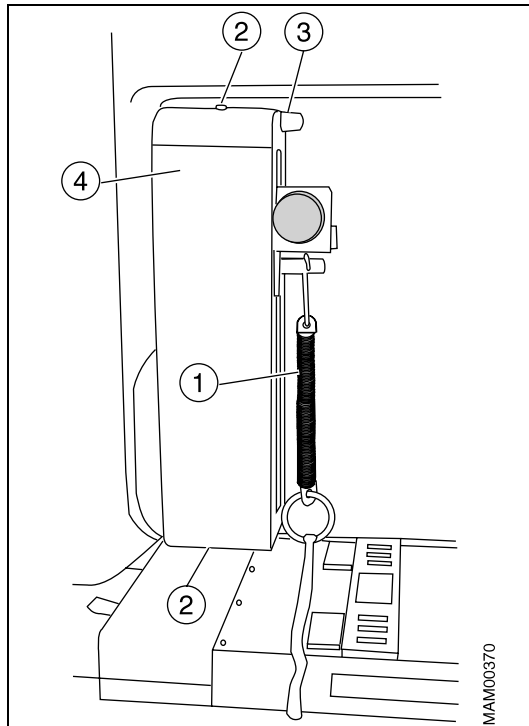


Fig. 2: Compression unit with covers

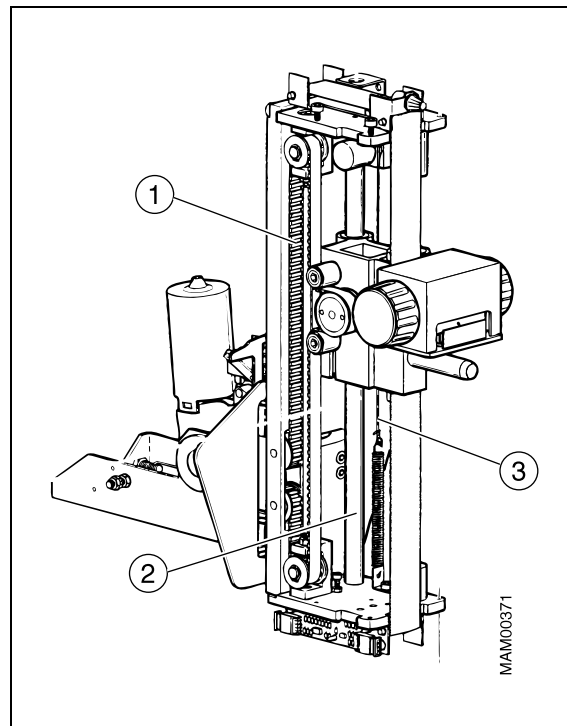


Fig. 3: Compression unit without covers

- Attach the spring scale as shown in (1/ Fig. 2 / p. 21).  
Tolerance:  $\pm 1$  kp.

### 4.2.1 Switching off

#### SIE Safety switch

- Does decompression switch off at a counter pressure of approximately 5 kp?  
⇒ Because of the measurement location, this value corresponds to a value of approximately 3 kp at the compression plate.

### 4.2.2 Travel

#### PMF Compression travel

- Move the compression plate up and down. Is the movement smooth and noiseless through the entire range?

### 4.2.3 Applying oil and grease

#### PMA Apply oil and grease to the compression unit

- System OFF

Remove the upper and lower covers (snap closures, [\(2/Fig. 2 / p. 21\)](#) and pot knob [\(3/Fig. 2 / p. 21\)](#)).

- After removing the "small" Allen screws (two above and two below), the right cover [\(4/Fig. 2 / p. 21\)](#) of the compression unit can be removed.
- Grease the rails [\(2/Fig. 3 / p. 21\)](#) lightly and check the belt [\(1/Fig. 3 / p. 21\)](#) and string [\(3/Fig. 3 / p. 21\)](#) for damage/wear as well as for tension.
- Reinstall the covers on the compression unit.

## 4.3 Compression thickness display

### PMF Thickness indicator

- System ON. Move the compression plate to its full height and measure the height.
  - ⇒ The value displayed (7/Fig. 1 / p. 13) must agree with the value measured.

## 4.4 Checking miscellaneous system movements

### 4.4.1 Checking miscellaneous system movements

**SIE Switch off**

- Check whether the motorized rotation movements shut off when a preset angle is reached. The angle (e.g. 90°) is preset with the potentiometer, [\(3/Fig. 1 / p. 13\)](#).
- Check the automatic switch-off function when passing the 0° position as well.

**PMF Rotation movements**

- Is the rotation movement smooth and noiseless through the entire range?
- Is the display correct [\(7/Fig. 1 / p. 13\)](#)?

**SIM Blocking rotation and vertical travel**

- Rotation and vertical travel must be blocked at a compression force of > 3 kp.



## 5 Test exposures

- System OFF
- Connect the following measurement devices:
  - Service PC to D702.X990
  - Oscilloscope to MP kVactual.X711 ( $1V \triangleq 5kV$ ) and mAactual.X707, OVA.X708 ( $1V \triangleq 40mA$ )
  - mAs meter to D710 (remove X3 - X4 jumpers)
  - Multimeter at MP.BIAS on D706 (measurement range 200V=)
- System ON
- Test the kV/mA control loop according to the Installation & Start-Up Instructions, chapter "Checks with high voltage".



## 5.1 Evaluating test values

**PMF Anode acceleration**

- Listen to the sound generated by the accelerating anode. Is the sound normal?

**PMF kV and mA**

- Do the measured kV and mA values agree with the values selected?

**PMF mAs selection**

- Do the measured mAs values agree with the values selected?

**PMF mAs value displayed**

- Does the measured mAs value agree with the displayed mAs value (for AEC)?

**PMF Grid voltage**

- Attach the magnification table. Measure the grid voltage (small focus) on tube test point G against test point H<sub>3</sub>. Does the measured value agree with the value in the test protocol?
- Test both focal spots (if available).

**PMF Signal lamp**

- Does the radiation-ON indicator light up?

## 5.2 Testing the dose rate control



- Cover the measurement field (e.g. with a lead apron) and release an exposure.

### **PMF Dose rate control**

- Does the dose rate control circuit switch OFF the exposure after approximately 100 ms? (The value is 50 ms for MAMMOMAT 1000/3000 Nova with serial no. 7000 and higher or MAMMOMAT 1000/3000 with a serial number lower than 7000 but upgraded with the "AEC upgrade kit", i.e. having
  - generator and stand with firmware version 4.0 or higher, and
  - service software version 4.1 or higher.)
- Check both wings (MAMMOMAT 3000 Nova only).

### 5.3 Testing the radiation field/light field



- Proceed with the test according to the Installation & Start-Up Instructions, chapter "Checking the radiation field limitation".

**PMF    Format collimation**

- Is the format collimation correct? (18 x 24, 24 x 30, small focus)

## 5.4 Testing image quality



- Attach the most frequently used exposure system (e.g. grid table 18 x 24).
- Load the "test cassette" with film and insert it.
- Position the SIB phantom over the 2-cm Plexiglas or other IQ phantom (e.g. Normi 7).
- Select the most frequently used kV value, AEC and automatic decompression.
- Compress slightly and release an exposure.

### **PMF Automatic decompression**

- Does decompression occur immediately following the end of the exposure?
- In addition, expose a sensitometer strip and develop the exposure.

## 5.5 Evaluating the films

### QIQ Phantom exposures

- Compare the phantom exposures to those on hand and/or archive them for the next maintenance as starting values.

## 6 Miscellaneous

### 6.1 Blocking exposure release

#### PMF Blocking

Exposure release must be blocked under the following conditions (indicated on the control console):

- No cassette is inserted.
- Cassette was not changed after the last exposure.
- Table is not attached or not locked in place.
- Wing 1 or wing 2 is not locked in place. (Mammomat 3000 Nova only).
- For stereo only: no external collimator for beam limitation in the collimator. (Mammomat 3000 Nova only).
- The two exposure release switches were not pressed simultaneously.
- No external collimator for 18 x 24 or magnification. (Mammomat 1000 only).

## 6.2 Checks

### SIE Emergency STOP

- Press Emergency STOP, see chapter "Compression and system movements" (4/Fig. 1 / p. 20).
  - Are the compression, rotation and vertical travel of the lifting carriage blocked?
- Release the Emergency STOP.

### PMF Indicators

- Check the LEDs on the operating console by starting the panel test via the service PC.

### PMP Error memory

- Read out the error memory and the exposure counter with the service PC.

### PMP Record the error memory.

### PMP Delete the error memory.

- Enter the data from the exposure counter and the error memory in the protocol and delete the error memory only.

### PMF Auxiliary voltages

- Use the voltmeter to measure the auxiliary voltages according to circuit diagram X041E, sheet 2-12/13 (test points on D801, D802 and D704).
- System OFF

### PMF Cassette locking

- Check that the cassettes being used lock in properly to the object tables.

### PMF OPDOSE

- Check the selection of various anode/filter combinations and OPDOSE according to the Installation Start-Up Instructions, chapter "Start-up and functional test of the ION-TOMAT" or "Calibrating and adjusting the AEC".

### PMF Stereo unit (Mammomat 3000 Nova only)

- If attached, check the stereotactic biopsy option according to the supplement to the Instructions for Use.

### PMA UIs and SPEED info

- Check whether all relevant UIs and SPEED info has been completed.



## 6.3 Final tests

- Remove the measurement devices.

### **PMF Operating problems**

- Were there any operating problems during the checks?

### **PMP Covers**

- Remove the protective strips and attach all removed covers. Check that all covers are completely and firmly attached, including the cable duct.

### **SIE Protective conductor test**

- Perform the protective conductor test according to ARTD-002.731.17....

### **PMP Cleaning/damaged paint**

- Clean the unit using the materials recommended in the Instructions for Use and repair any damaged paint.
- System ON.

### **QSQ Final test exposure**

- Take one final test exposure.

**7 Changes since the previous version**

Document was converted to DMS.